

Putting from the Rough: Ecological and Social Restoration of a Former Golf Course

A Case Study from the Structured Decision Making Workshop

Course Dates February 9 – 13, 2015

Course Location: National Conservation Training Center, Shepherdstown, WV

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Decision Problem

In May 2014, the U.S. Fish and Wildlife Service (USFWS), Shiawassee National Wildlife Refuge received the former 135-acre Germania Town and Country Club as donation from The Nature Conservancy (TNC). TNC purchased the property (which fell into foreclosure in 2010) with support from The Dow Chemical Company. The Refuge seeks to develop a restoration plan which maximizes ecological and social objectives utilizing Natural Resources Damage Assessment (NRDA) funds. In 1998, a co-trustee group consisting of the USFWS, the State of Michigan, and the Saginaw Chippewa Tribe negotiated a settlement for natural resources damages with the General Motors Corporation and the Cities of Bay City and Saginaw. The settlement provides for substantial cleanup of river contamination and for protection and restoration of fish and wildlife habitats in the Saginaw River and Bay. Specifically, NRDA funds are available for restoration plan development and implementation under the Green Point Environmental Learning Center (GPELC) projects and elements section of the settlement and restoration. The decision makers for the project are Shiawassee NWR Refuge Manager, Ecological Services, and the co-trustee group.

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Background

Legal, regulatory, and political context

There is approximately \$614,000 available in NRDA funds available for this restoration project. The group seeks to write a restoration plan for the GPELC area, including the former Germania golf course, that guides restoration activities to maximize the ecological and social objectives of the project and complies with both NRDA and National Environmental Policy Act (NEPA) guidelines. The group looks to implement restoration goals in part based on a recently completed hydrogeomorphic (HGM) evaluation completed for Shiawassee NWR. The project area lies within the City of Saginaw and includes the 135 acres of the former golf course, 60 acres in the Hickey tract, and the 80 acre parcel owned by the City of Saginaw and managed by the Service that includes the building that houses the learning center classroom and offices. The restoration of the former golf course within the GPELC area not only provides a unique opportunity to restore 135-acres of habitat within an urban area, but also the opportunity to connect urban residences with the National Wildlife Refuge System (NWRS) through the existing network of trails and ponds present (Fig. 1). In addition, there is a separate NRDA on-going with the Dow Chemical Company (Dow) that includes the Tittabawassee River and its floodplain.

Ecological context

Vegetation communities present in Michigan during the pre-settlement (i.e., pre-European settlement) are available for the entire State of Michigan and are based on interpretation of General Land Office surveys from the early-1800s. This data provides geospatial information on the types and distribution of general habitats historically present in the Shiawassee flats region in the pre-settlement period (Albert and Comer 2008 and Comer et al. 1995). These GLO-based maps indicate that the Shiawassee flats region contained a central core of shrub swamp-emergent marsh surrounded by diverse black ash, and mixed hardwood swamp forest (Heitmeyer et al. 2013). According to the interpreted GLO notes the Greenpoint area consisted mostly of beech sugar maple forest (Fig. 2). Beech sugar maple forests are a transitional forest types from true floodplains to uplands (Barnes and Wagner 1981, Dickman and Leefers 2004, Kost et al. 2010). Although, the interpreted GLO notes indicate Beech sugar maple forest based on information collected during a HGM evaluation indicate the area, particularly the areas closer (i.e., lower elevation) to the Tittabawassee River consisted of mixed hardwood swamp. The HGM process looks at the historical distribution of major vegetation communities/habitat types in the Shiawassee flats region in relationship to geomorphic surface, soils, topography, and hydrological regime to produce a matrix of habitat/cover types and a map of the potential distribution of cover types (Heitmeyer et al. 2013).

If we assume some of this area was more of a floodplain forest or mixed hardwood swamp these forest types can best be characterized by Michigan Natural Features Inventory (MNFI) descriptions of natural communities (e.g., floodplain forest and southern hardwood swamp). Floodplain forest is a bottomland deciduous forest subject to periodic over-the-bank flooding with cycles of erosion and deposition (Kost et al. 2010). Floodplain forest vegetation varies and changes along a gradient of flooding frequency and duration but in general the major tree species include; silver maple (*Acer saccharinum*), green ash (*Fraxinus pennsylvanica*), and American

elm (*Ulmus americana*; Kost et al. 2010). Southern hardwood swamp is similar to floodplain forest in that they occupy shallow depressions or are situated along high-order streams (Kost et al. 2010). The canopy is typically dominated by silver maple (*Acer saccharinum*), red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*), and black ash (*Fraxinus nigra*; Kost et al. 2010).

Although we have fairly good information on pre-settlement conditions the former golf course site has been highly altered, undoubtedly affecting the function and structure of any pre-settlement vegetative community we try to establish. Prior to the establishment as a golf course the entire Germania tract was logged, cleared, and converted to agriculture (Fig. 3). We believe there still remains a network of sub-surface tiles which influence the hydrology of the site. The majority of the Germania tract of land consists of non-native turf grasses and ornamental trees and shrubs. The shoreline along the Tittabawassee River on the Germania tract has been “hardened” by placing impervious material such as concrete and rock. Invasive species such as common buckthorn (*Rhamnus cathartica*), garlic mustard (*Alliaria petiolata*), and a variety of other non-native invasive species have become well established in all three tracts of the GPELC area. Furthermore, one of the dominant overstory trees at GPELC is green ash, which is mostly dead or dying from emerald ash borer (*Agrilus planipennis*; a non-native Asian beetle that feeds on ash species).

Decision Structure

Decision Problem

Our group framed the problem based on ecological and social objectives that meet the mission of the USFWS National Wildlife Refuge System and Shiawassee NWR while fulfilling the obligations of the NRDA agreement. Our problem statement was to determine how to best restore floodplain habitat and provide public use on GPELC area using settlement funds over the next 20 years while minimizing constraints for future actions.

Constraints

Prior to setting objectives we identified several constraints which were used throughout the workshop in objective setting and developing alternatives. These constraints included:

1. Funding – We have approximately \$614,000 available in NRDA funds for this project that are to be used to restore, replace, or acquire the equivalent of the natural resources that were injured by the release of hazardous substances. Of the funds available, NRDA guidelines suggest that approximately 10 – 20% can be used for planning activities, 10 – 15% can be used for improving public use of natural resources (e.g., trails, kiosks, interpretive signs), and the remaining funds are to be used for direct implementation, monitoring and maintenance of habitat restoration to benefit natural resources. The NRDA funds are not associated with a fiscal year and are in an interest bearing account.
2. Contaminants – There is an ongoing NRDA for releases of hazardous substances from Dow’s plant site in Midland, Michigan. Hazardous substances, including dioxins, were released into the Tittabawassee River and are now present in the river and its floodplain. The Michigan Department of Community Health has issued consumption advisories for fish from the river and wild game harvested from the floodplain (MDCH 2015, 2008).

- a. In the southeast corner of the 80 acre GPELC tract, investigations have identified an area with relative high concentrations of dioxins along the Tittabawassee River. Dow may be required to remove soil there in the future and in the meantime no public use activities should be planned for this area that would increase soil exposure.
 - b. The State of Michigan has issued advisories about moving soil within the 100-year floodplain of the Tittabawassee River in order to minimize or eliminate soil displacement and increased exposure to or erosion of contaminated soils (MDEQ et al., undated). Nearly all of the GPELC area is within the 100 year floodplain.
 - c. Any dirt moving or shoreline engineering along the Tittabawassee River would likely require additional soil testing, disposal at a licensed landfill, and contingency funding in case additional contaminants are discovered.
3. Refuge resources (i.e., refuge funds/budget and refuge staff time) – We wanted to explicitly recognize the fact that the actions we take toward restoring this site will require long term maintenance and oversight. Therefore we added a constraint that actions that would require a large investment in refuge staff time or funding would not be considered unless those costs could be covered with the available NRDA funds.
4. DTE Energy Company - Shiawassee NWR has an agreement with DTE Energy Company to provide 200 acres on the refuge for DTE to plant trees in which they will earn carbon sequestration credits. For the portions of the restoration sites that we plan to reforest we plan to explore using this agreement to purchase and plant the trees. This would allow us to maximize the NRDA funding for other aspects of the restoration but we further communication between the refuge and DTE needs to occur to ensure the restoration goals and agreement are compatible for this site.
5. Restoration actions will not inhibit future actions – During our planning process we recognized a need to write a Visitors Services plan for the GPELC area. In addition, any decisions made now will not inhibit any future actions or implementation of future plans (e.g., don't build new trails right along Tittabawassee River because this may prevent shoreline softening at a later time).

Objectives

Fundamental objectives were set by the group and reflected ecological and social goals of the project. We developed an objectives hierarchy based on the problem statement (how best to restore floodplain habitat and provide public use on Greenpoint area using settlement funds over the next 20 years while minimizing constraints for future actions) and included the following fundamental objectives; (1) restoration closer to pre-European conditions, (2) connecting local people with nature, (3) maximizing public support while being a community asset, (4) costs (initial and long-term refuge resources), and (5) minimize any increase in contaminant exposure (Fig. 4). We developed two means objectives for one of the fundamental objectives (restoration closer to Pre-European conditions): Having the correct spatial arrangement of habitat types on the landscape (e.g., % of forested habitat versus % another landcover type) and having habitat types that are structurally and functionally able to support wildlife communities similar to what was historically present. Once the objectives were set we created measurable attributes to measure the success of achieving that objective (Fig. 4).

Alternative actions

We developed alternatives by first identifying a list of actions that could be undertaken and grouping these actions into themes such as “reforestation” or “public use”. By structuring the many actions under themes it was easier to develop a short list of alternatives that both spanned the range of what could be done and were strategically aligned with our objectives from the vast number of alternatives that potentially could have been developed for the restoration project (Table 1). We created alternatives by selecting strategies from the different themed lists to create alternatives with varying focus on the objectives (portfolio approach). This approach was very useful since we could develop numerous alternatives that varied widely or alternatives that were similar. We began developing these alternatives by starting with two alternatives that varied widely (i.e., an alternative that maximized restoration and an alternative that maximized native prairie planting). We used difference in vegetation cover as the extremes since the amount of funds that can be spent on public use and infrastructure are capped at approximately 20%.

Alternative 1 – Maximize Restoration (focus on ecological restoration that will be guided by forest inventory and ecological classification work, public use focuses on establishing a trail system on the Germania tract that would connect to existing trails on Greenpoint tract creating a new linked trail system for the GPELC area).

Actions:

1. Tree planting across entire golf course, if possible funded through DTE.
2. Invasive species treatment across entire GPELC area.
3. Forest inventory and ecological classification which will be used as reference information to guide reforestation work.
4. Build new trails on Germania.
5. Remove existing asphalt golf cart trails.
6. Demolition and removal of existing buildings on Germania.
7. Hire a seasonal land management technician to take lead on invasive species and land management activities on the entire Greenpoint area.

Alternative 2 – Maximize Public Use (focus on public use and use by the local community at the expense of habitat restoration recognizing the potential value of outreach and education can have long term outcomes that may outweigh the reduced use by wildlife)

Actions:

1. Tree planting on west side of Maple Street on Germania, if possible funded through DTE.
2. Native prairie planting on east side of Maple Street on Germania.
3. Invasive species treatment, entire GPELC area.
4. Forest inventory and ecological classification on the refuge which will be used as reference information to guide reforestation work.
5. Build new trails on Germania.
6. Remove existing asphalt golf cart trails.
7. Demolition and removal of existing buildings.
8. Install new signs and kiosks.

9. Connect new trails to existing trails at the rest of GPELC.
10. Create new access points to the area specifically targeting increasing accessibility to local school and local residents.
11. Restore wetland at “Big Pond” (existing pond located on Germania, east of Maple Street).
12. Hire a seasonal land management technician to take lead on invasive species and land management activities on the entire Greenpoint area.

Alternative 3 – Maximize Ecological and Social Planning Prior to Restoration (focus pre-restoration planning efforts to guide ecological restoration and public use goals by conducting a community needs assessment to better understand how the local community would and wants to use the GPELC area).

Actions:

1. Tree planting on west side of Maple Street, if possible funded through DTE.
2. Invasive species treatment, across entire GPELC area Forest inventory and ecological classification on the refuge which will be used as reference information to guide reforestation work.
3. Conduct a community needs assessment to inform what local community wants to see from restoration and how they would use the area. This information will guide development of social restoration goals.
4. Hire a landscape architect or partner with landscape architecture program at a local University to design area east of Maple Street informed by the community needs assessment as an area that will be inviting to the general public.
5. Build new trails on Germania.
6. Remove existing asphalt golf cart trails.
7. Demolition and removal of existing buildings.
8. Connect new trails to existing trails at the rest of GPELC.
9. Other habitat work and contingency.

Alternative 4 – Maximize Native Prairie Planting (focus on establishment of native prairie on the Germania tract for grassland dependent species by providing a large block of native prairie, public use focuses on establishing a trail system on the Germania tract that would connect to existing trails on Greenpoint tract creating a new linked trail system for the GPELC area)

Actions:

1. Plant native prairie plants across entire Germania golf course
2. Invasive species treatment, across entire GPELC area.
3. Hire a landscape architect or partner with landscape architecture program at a local University to design area east of Maple Street informed by the community needs assessment as an area that will be inviting to the general public
4. Build new trails on Germania
5. Remove existing asphalt golf cart trails.
6. Demolition and removal of existing buildings.
7. Connect new trails to existing trails at the rest of GPELC.
8. Other habitat work and contingency that

Decision Analysis

To analyze the data we used a Simple Multi-attribute Ranking Tool (SMART), also called a consequence table. We created a ranking system for each of the measurable attributes and then assigned a score to each measurable attribute for each alternative. This allowed us to compare alternatives against each other based on their scores (Table 2). We compared the alternatives with both un-weighted and weighted scores (swing weighting) and then conducted a sensitivity analysis to see which measurable attributes were most important in choosing the best alternative.

The highest ranking alternative varied by the weighting system used; alternative 1 (maximize restoration, alternative 2 (maximize public use), and alternative 3 (maximize ecological and social planning prior to restoration) all scored very close together in all three weightings (Table 2). Alternative 4 (maximize native prairie restoration) was the lowest ranking alternative in all three scenarios, and was eliminated from consideration.

Uncertainty

Our group identified several sources of uncertainty during the workshop. For the ecological objectives, the Refuge does not have a comprehensive forest inventory or ecological classification. This reference data is needed to set measurable goals and objectives for the forest restoration and any floodplain restoration that would be conducted, and was clearly identified as a data need from the workshop. There is also uncertainty whether DTE Energy Company will agree to reforest all or a portion of the restoration site. There is an existing agreement to plant 200 acres somewhere on the Refuge, but it is unclear if DTE will agree to this and if their goal of carbon sequestration credits will match the Refuge's goals.

The group also identified uncertainty in the social objectives, specifically uncertainty associated with what the community preference is for the site. A formal community needs assessment or engaging the local community to discover what they want from the restoration of this area is needed. This community needs assessment would be useful in guiding not only public use infrastructure but potentially vegetative cover that would be more inviting to urban residents.

Discussion

Value of decision structuring

Our group found great value in the structured decision making process. Prior to the workshop our planning team attempted a few in person meetings and conference calls to start planning the restoration. Attending the workshop and being able to spend a week working with our coaches put us at least a year ahead of schedule in the planning process. The products from the workshop will be used to develop the restoration plan and environmental assessment (EA) that are required before the funds can be allocated. The alternatives that we developed will be used for the alternatives sections of the EA along with the analysis we used to evaluate the alternatives.

Further development required

We need to further refine our cost estimates for the different alternatives. Alternatives one, two, and three all had similar rankings; this was due in part to the precision of the cost estimates we used for evaluating the alternatives (e.g., professional judgment was primarily used to estimate costs for all the actions). In addition, we need to further refine and revisit the alternatives that we developed. There were assumptions that went into the current alternatives (e.g., using DTE Energy Company to purchase and plant trees); if the assumptions are not viable then we need to refine them.

Recommendations and Next Steps

The next steps for this project include writing the restoration plan and Environmental Assessment. The group will further refine cost estimates and alternatives. There were two major data gaps identified during the workshop; forest inventory and ecological classification, and a community needs assessment. Both of these will be critical steps needed to further refine alternatives and set realistic and measureable goals and objectives for the project.

Since the NRDA funding available for this project is not associated with a fiscal year we decided that this project should take a phased approach. The first phase consists of design and planning, followed by a phased implementation strategy and then a monitoring and evaluation phase which won't be developed until the restoration design is complete. With a limited budget we will probably not have funds to develop a full monitoring plan of all the actions that will be implemented we will seek additional funds to assist in the development of this monitoring plan.

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Fig. 1. Location of Germania golf course and Greenpoint environmental learning center at Shiawassee National Wildlife Refuge, Saginaw, MI, USA.

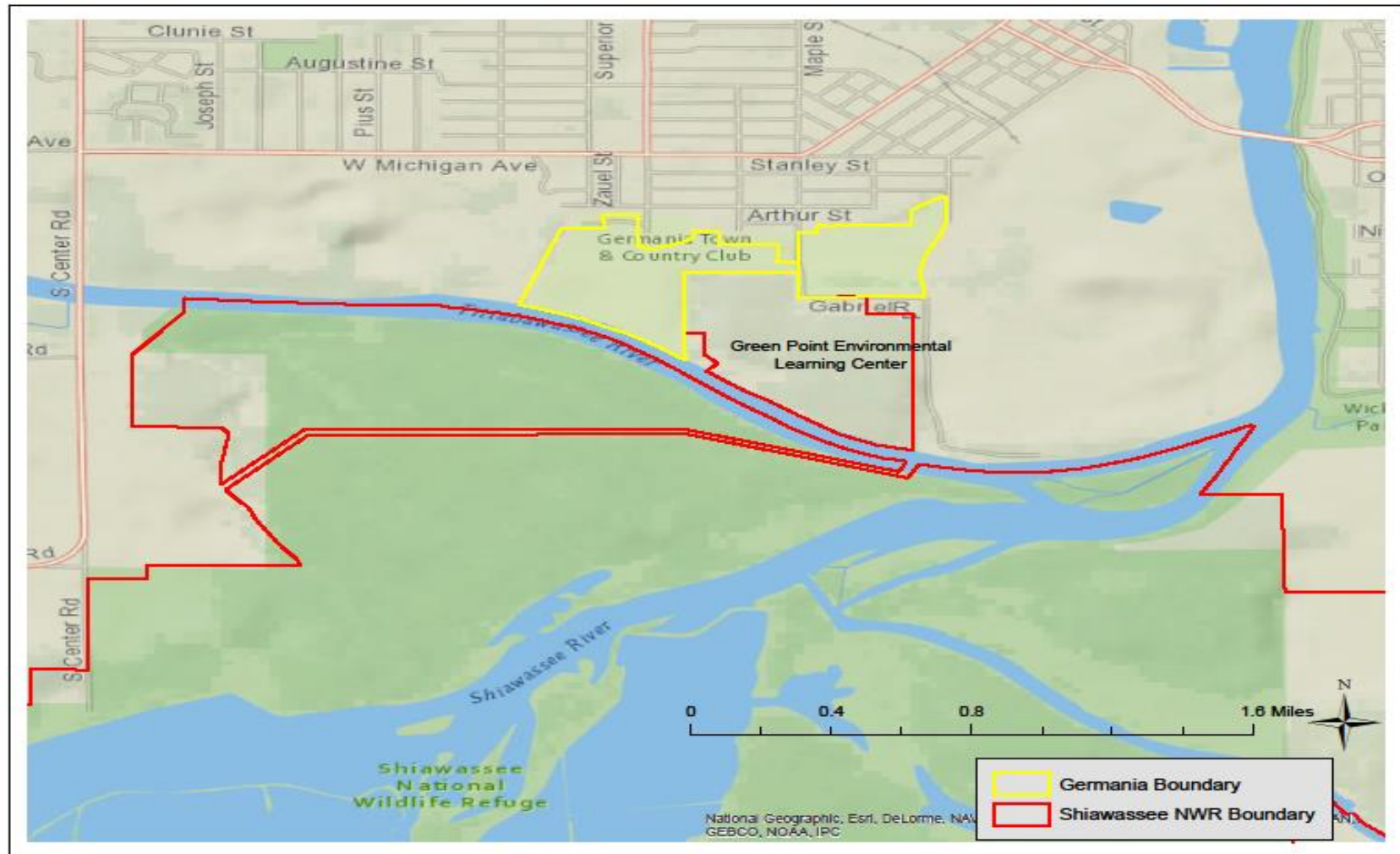


Fig. 2. Pre-settlement (pre-European) vegetation communities interpreted from the General Land Office survey notes from the 1800's for the Greenpoint area at Shiawassee National Wildlife Refuge, Saginaw, MI, USA.

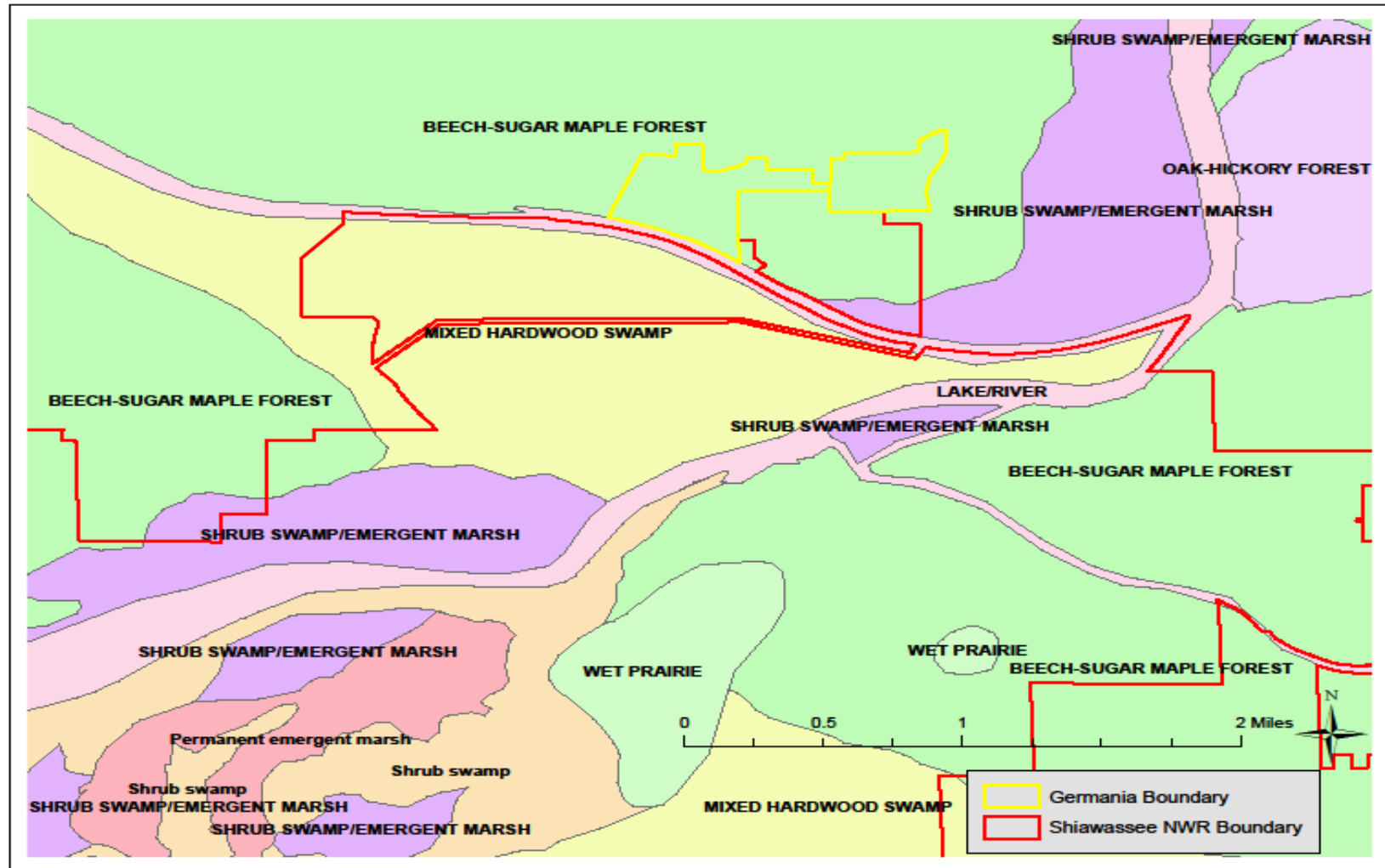


Fig. 3. Historical aerial image (circa 1937, the earliest aerial imagery available for the State of Michigan) of the Greenpoint area including the former Germania golf course (yellow boundary), which shows the forest on the golf course were cleared and converted to agriculture.



Fig. 4. Objectives hierarchy for the ecological and social restoration of the Greenpoint area at Shiawassee National Wildlife Refuge, Saginaw, MI, USA.

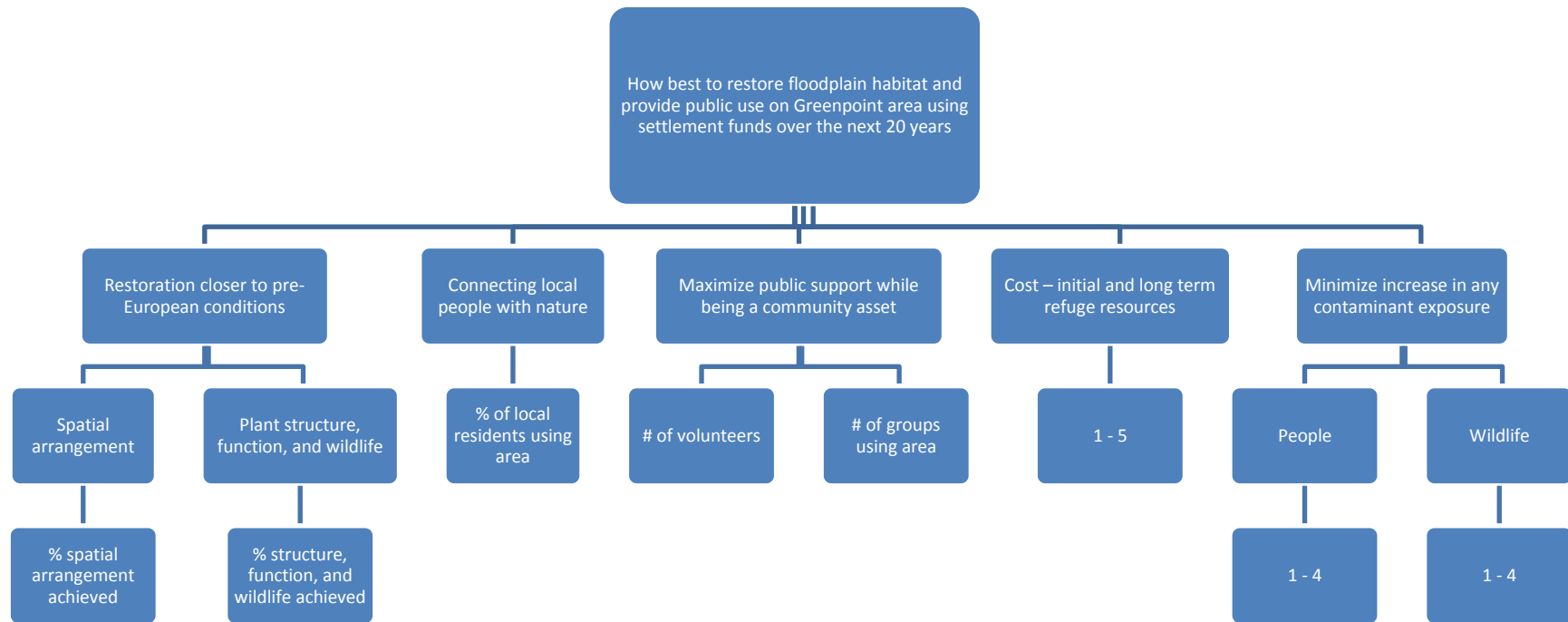


Table 1. Themes and actions used to develop alternatives for the ecological and social restoration of the Greenpoint area at Shiawassee National Wildlife Refuge, Saginaw, MI, USA.

	Themes				
	Reforestation current conditions	Reforestation systems approach	Habitat Diversity	Public Use	Public Use Infrastructure
Actions	Tree planting	Soil testing	Prairie planting	Volunteer programs	Path to school
	Irrigation	Tile breaking	Oxbow reconnection	Interpretation	Loan golf carts
	Invasive species control	Grading	Wild rice restoration	Create city bus stop at Greenpoint	Build observation tower
	Soil testing	Hydrologic analysis	Prescribed grazing	Partner with Saginaw children's zoo	Build fishing pier on "Big Pond"
	Tile breaking	Shoreline softening	Prescribed fire	Public service announcements	Reconfigure trails to connect Germania and Greenpoint
	Herbivory control		Mowing	Hire a marketing firm	Canoe/kayak launch
	Forest inventory and ecological classification			Community needs assessment	Abandon Greenpoint ELC (build new learning center)
	Hire seasonal bio-tech			Staff into community	Build covered shelter
				Enhance youth fishing program	Move Maple and Gabriel roads
				Deer hunt	Archery area
				Loan recreational equipment	Community gardens
				Fish stocking on pond at Germania	Signage/kiosk on and off site
				Status quo	Contaminant test and contingency
					Tittabawassee river fishing pier
					Improve access for public (trail heads)
					Bike racks

Table 2. Simple multi-attribute ranking tool (consequence table) used to evaluate four alternative actions for the ecological and social restoration of the Greenpoint area, Shiawassee National Wildlife Refuge, Saginaw, MI, USA.

			Alternatives			
Fundamental and Means Objectives	Goal	Measurable Attributes (Units)	Alt 1 Max Restoration	Alt 2 Max Public Use	Alt 3 Max Planning	Alt 4 Maximize Prairie
Closer to pre-European Conditions						
Spatial arrangement	Max	Similarity to pre-European spatial arrangement achieved (%)	85.00	60.00	65.00	50.00
Plant structure and function	Max	Similarity to pre-European structure and function achieved (%)	51.60	43.30	29.00	35.00
Connecting locals to nature	Max	Increased use by local nature novices (% locals using GP area)	5.00	30.00	50.00	20.00
Maximize Public Support						
	Max	Number of volunteers (#)	15.00	20.00	45.00	20.00
	Max	Number of groups using Greenpoint Environmental Learning Center (#)	30.00	37.00	45.00	37.00
Refuge Resources						
	Min	Opportunity cost now (1 - 5)	3.00	3.00	5.00	4.00
	Min	Opportunity cost later (1 - 5)	2.00	3.50	5.00	4.00
Minimize increase in contaminant exposure						
	Max	People exposure (++, +, 0, -; 1-4)	1.00	1.00	1.00	1.00
	Max	Wildlife exposure (++, +, 0, -; 1-4)	1.00	1.00	1.00	1.00
Un-Weighted final score			0.40	0.43	0.21	0.13
Swing weighting score 1			0.51	0.51	0.56	0.28
Swing weighting score 2			0.55	0.51	0.53	0.28

